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MEASURES FOR THE CONTROL OF MALAYAN FILARIASIS IN
SHERTALLAI, SOUTH INDIA**

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COMMUNITY HEALTH CELL

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ABSTRACT

Epidemiological assessment of integrated disease control programme was carried out after 3 years of implementation of the programme in Shertallai, Kerala, which is endemic for *Brugia malayi* infection. Fish culture in domestic ponds, involving different species of carps including weed eating grass carp was implemented to control weeds and thereby breeding of vector (Mansonioides) mosquitoes. Parasite control was attempted through annual and biannual single dose mass DEC treatment at 6mg/kg body wt. A significant proportion (70.15%) of fish culture ponds was maintained free from weed reinfestation. Analysis of various epidemiological indices indicated that an effective reduction (69-90%) in the parasite load was achieved following mass DEC treatment and biannual treatment was found to be superior to annual treatment. In the vector control area though there was significant reduction in the mF prevalence (62%) and recruitment of new lymphoedema cases (78.7%), the incidence of new mF cases was not brought down to zero as seen in mass treatment area. Interruption in transmission was evident from the significant reduction in vector density (72-83.9%) and proportion of infected vector mosquitoes (62.2%) following the implementation of vector control and parasite control measures respectively. Both vector control and mass treatment were found to be feasible as well as acceptable by the community as the former was linked with income generating scheme and the latter reduced morbidity. The importance of integration of vector control with parasite control and community acceptance in eliminating the foci of transmission is discussed.

INTRODUCTION

In India, malayan filariasis caused by *Brugia malayi* is limited to a few pockets where an estimated 3 million people are at risk of this infection (Sharma, et al., 1983). The largest endemic tract of this disease is in the central part of Kerala with an area of about 1800 sq.kms. (Rao, et al., 1978). Vector control measures were initiated as early as 1933 by the State Filariasis Control Works, an organisation engaged in manual removal of the host plant, *Pistia* in Shertallai and Ambalapuzha municipal areas of Kerala (Singh, et al., 1956; Anonymous, 1961). In 1966, a field research unit for the control of this infection was established by the National Institute of Communicable Diseases which carried out studies on the effectiveness of different methods of control (Rao, et al., 1980). However, these activities were restricted to an area of about 80 sq.kms. in Shertallai when the problem is severe in the whole of Shertallai taluk covering an area of 304 sq.kms., with a population of about 400,000. Therefore, in 1986 Vector Control Research Centre (VCRC) launched an integrated disease control programme to accelerate the reduction of infection and disease. The results of interim epidemiological surveys, carried out three years after the initiation of control programme are presented in this communication.

STUDY AREA AND METHODS

Shertallai taluk in Alleppey District (09° 42'N 76° 20'E) in Kerala State lies in the low land region sandwiched between Vembanad lake in the east and Arabian sea in the West. The whole taluk is waterlogged with an estimated number of 75,000 ponds and over 390 kms length of canals and channels which drain out water. These water bodies are infested with aquatic weeds such as *Pistia stratiotes*, *Salvinia molesta* and *Eichhornia crassipes*, to the roots of which the immatures of vector species get attached for their respiration and survival. All three species of *Mansonia* viz., *Mansonia annulifera*, *M.uniformis* and *M.indiana* have been incriminated as vectors of malayan filariasis in this locality (Iyengar, 1938).

Under the VCRC integrated disease control programme both anti-vector and anti-parasite measures were undertaken. Precontrol epidemiological observations have already been reported (Rajagopalan, et al., 1987).

Vector control measures:

Composite fish culture involving fast growing edible fish varieties such as *Catla catla*, *Labeo rohita*, *Cirrhana mrigala*, *Cyprinus carpio*, *Labeo fimbriatus* and weed eating grass carp,

Ctenopharyngodon idella was introduced in 1986 to control aquatic weeds and thereby breeding of *Mansonioides* mosquitoes. Kadakaraipalli, a village with a population of 16,165 (1981 census) was selected for assessing the fish culture programme in the control of vectors. A total of 2,065 ponds were enumerated in this area of which 1,467 ponds were found fit for fish culture as the rest were polluted due to husk retting. All the suitable ponds were stocked with fish fingerlings of the above varieties at the rate of 25/100m². All the ponds including polluted ones were deweeded initially and the suitable ponds were prepared for fish culture by the community. Removal of weeds in the polluted ponds was also done by the community as and when the weeds started reappearing. All these ponds were restocked with fish fingerlings following their harvest after 10 to 12 months.

Parasite control:

Two areas in Shertallai South Panchayat, with population of 22,681 in 5,639 households and 6,192 in 1,749 households were selected for evaluating the effectiveness of mass single dose DEC treatment (6 mg/kg body wt.) given annually and biannually respectively. Pre school children were covered at 'anganwadi centres' while school children at schools. House visits were also made to cover the adult population. These visits were made between 19.00 and 22.00 hours in order to cover all the family members who were expected to be at home during these hours. Infants and pregnant women were not included. Dosage was decided based on body weight, and, on the spot intake of drug was ensured by the team. A team including a physician visited all the households/ schools on the following day to monitor and treat side reactions, if any. First round of annual and biannual treatment was initiated in the month of April 1987, second biannual in the month of October 1987, third round of biannual and second round of annual in the month of April 1988 and fourth round of biannual in the month of October 1988. All the rounds were completed within 2 to 3 months from the initiation of treatment.

A check area with a population of 49,836 was maintained without any intervention measures and this area is contiguous as well as ecologically and epidemiologically comparable. A barrier zone was also maintained to reduce the chances of infiltration of mosquitoes to and from other areas under intervention.

Evaluation:

Pre control parasitological and clinical surveys were made with a minimum target coverage of 10 % and 2 % of the population for parasitological and clinical examination respectively, in

all the four areas. Finger prick method with 20 cmm blood sample was followed for microfilaria (mF) survey. Clinical case detection was done following standard criteria (WHO, 1985). These surveys were repeated after six months of the completion of last round of mass treatment as recommended by WHO (WHO, 1974). A cohort of population surveyed in 1986 (pre control) was also resurveyed in 1989 (post control).

Entomological assessment was made by collecting indoor resting mosquitoes from fifteen catching stations in each study area. Hand catch by using oral aspirators, spending a total of 6 man-hours in each collection was followed at fortnightly intervals. Man vector contact was also monitored by conducting all night man biting collections, at monthly intervals in all the study areas. These collections were carried out from tenth and seventh month prior to the introduction of vector control measures and mass treatment and continued upto seventeenth and thirty fourth month after the introduction of the above control measures respectively. All the mosquitoes collected from the above methods were identified and dissected for filarial infection. The number of developing larvae was also recorded from the positive mosquitoes.

Chi-square test, Student T-test and Log Odds ratio test were used wherever applicable. The annual incidence of new mF positive persons in the age class 1-7 years was worked out following Kimura et al., (1985). Infectivity index of the human population was assessed in the pre and post control surveys following the method recommended by WHO (WHO, 1974). Rates of gain and loss of infection in the human population were estimated from the longitudinal followups following the method of Vanamail et al., (1990).

RESULTS

During the precontrol survey a total of 670 ponds were examined, of which 585 (87.31 %) were found to be naturally infested with floating weeds viz., *Pistia stratiotes*, *Salvinia molesta* and *Eichhornia crassipes*, the natural host plants of *Mansonioides*. Vector breeding was observed in 41.60% of 500 weed infested clean ponds. A total of 670 ponds, selected at random was monitored at the end of 10 months following the introduction of fish culture. As many as 470 (70.15%) ponds were maintained completely free from weeds. Though there was partial reinfestation of weeds in the remaining ponds none was found to support vector breeding. In the check area out of 444 ponds surveyed, 377 (84.91%) were found to be naturally infested with weeds, of which 148 (39.25%) were found to support vector breeding and there was no significant change in the proportion of ponds with weed infestation ($\chi^2 = 3.35$; $P = 0.06$) as well as vector breeding ($\chi^2 = 0.39$; $P = 0.528$) between the periods corresponding to pre and post

The population covered under annual single dose mass treatment was 13,982 (62.11%) in the first round and 13,278 (58.99%) in the second round. In the biannual mass treatment the coverage was 2,909 (47.29%), 2,542 (41.33%), 3,232 (52.54%) and 4,060 (66.01%) respectively in first, second, third and fourth rounds. The coverage was minimum in the age class 0-9 years (27.94% to 49.10%) and was maximum in the age class 10-19 years (57.54% to 98.18%). The proportion of people showing side reactions ranged from 6.21% to 8.4% in different rounds of mass treatment. Fever and head ache were the predominant reaction (62.8% of the total cases developed side reactions).

Parasitological:

The age structure of the population and the sample covered under parasitological survey in all the four areas are given in table 1. Age specific analysis on the coverage showed that the target minimum was achieved in both pre and post control surveys in all the age classes except 0-9 years and this was due to unwillingness of the parents to get their children finger pricked.

The age specific prevalence of microfilariae (mF) in the pre and post control surveys in vector control, annual mass treatment, biannual mass treatment and check areas are shown in figure 1A-D. Age specific analysis on mF prevalence showed that in the pre control surveys the lowest mF prevalence was seen in the age class 0-9 years and the maximum in 10-19 years in all the study areas. There was a reduction in the overall mF prevalence in all the study areas and it was minimum in the check area. While the reduction in proportion of mF carriers was significant in all the three control areas it was not significant in check area (Table 2). The age specific pattern of pre and post control mF prevalence showed that over 50% reduction in mF prevalence was achieved in all the age classes in all the three control areas and it was less than 50 % in check area. Increase in mF prevalence in the age class 0-9 years in the check area, though not significant, revealed the higher rate of acquisition of new cases. When the reduction in mF prevalence was compared using Log Odds ratio, maximum reduction was seen in biannual mass treatment area (Table 2) which was significantly ($Z = 6.99$; $P < 0.05$) higher than in the annual mass treatment area. When compared to vector control area the reduction in annual mass treatment area was significantly ($Z = 18.31$; $P < 0.05$) higher. However, the proportion of microfilaraemia cases was significantly ($Z = 102.86$; $P < 0.05$) brought down in vector control area when compared with that of check area.

Table 1: Age distribution of population, and, samples in microfilaria and clinical surveys in study population

Area	Age class	Pre-control						Post-control			
		Population	coverage in surveys				Population	coverage in surveys			
			microfilaria		clinical			microfilaria		clinical	
			No.	%	No.	%		No.	%	No.	%
Vector control											
	0- 9	4769	343	7.19	105	2.20	4845	639	13.19	82	1.69
	10-19	3427	590	17.22	166	4.84	3482	1059	30.42	161	4.62
	20-29	2473	381	15.41	102	4.12	2513	969	38.57	128	5.09
	30-39	2037	318	15.61	82	4.03	2070	732	35.37	93	4.49
	>=40	3459	572	16.54	184	5.32	3514	1419	40.38	207	5.89
	Total	16165	2204	13.63	639	3.95	16424	4818	29.34	671	4.09
Annual mass treatment											
	0- 9	6691	499	7.46	165	2.47	6768	343	5.07	116	1.71
	10-19	4808	742	15.43	146	3.04	4864	606	12.46	183	3.76
	20-29	3470	525	15.13	131	3.78	3510	475	13.53	166	4.73
	30-39	2858	398	13.93	107	3.74	2891	351	12.14	124	4.29
	>=40	4854	821	16.91	202	4.16	4910	663	13.50	218	4.44
	Total	22681	2985	13.16	751	3.31	22943	2438	10.63	807	3.52
Biannual mass treatment											
	0- 9	1828	130	7.11	100	5.47	1850	105	5.68	93	5.03
	10-19	1314	229	17.43	81	6.16	1329	170	12.79	88	6.62
	20-29	948	184	19.41	76	8.02	959	161	16.78	104	10.84
	30-39	781	139	17.80	59	7.55	790	122	15.44	73	9.24
	>=40	1326	275	20.74	127	9.58	1342	253	18.86	142	10.58
	Total	6197	957	15.44	443	7.15	6270	811	12.93	500	7.97
Check area											
	0- 9	2042	52	2.55	26	1.27	10022	564	5.63	133	1.33
	10-19	1468	149	10.15	26	1.77	7202	834	11.58	170	2.36
	20-29	1059	106	10.01	27	2.55	5198	768	14.78	168	3.23
	30-39	872	92	10.55	26	2.98	4280	649	15.16	129	3.01
	>=40	1481	177	11.95	50	3.38	7270	999	13.74	225	3.09
	Total	6922	576	8.32	155	2.24	33972	3814	11.23	825	2.43

Table 2: Age specific Microfilaria prevalence and intensity in study population

Area	Age class	mf prevalence in %			Proportion significance P value	mf intensity*		
		Pre-control	Post-control	% change		Pre-control	Post-control	% change
Vector control								
	0- 9	1.75	0.47	-73.29	0.0515	0.624	0.019	-97.00
	10-19	4.75	1.67	-64.78	<0.05**	0.892	0.132	-85.21
	20-29	3.67	1.82	-50.37	0.0671	0.522	0.176	-66.25
	30-39	2.83	0.81	-71.27	<0.05**	0.220	0.037	-83.38
	>=40	2.97	1.18	-60.17	<0.05**	0.477	0.130	-72.86
	Total	3.36	1.27	-62.16	<0.05**	0.582	0.111	-80.94
Annual mass treatment								
	0- 9	2.20	0.00	-100.00	<0.05**	0.148	0.000	-100.00
	10-19	5.93	1.49	-74.95	<0.05**	1.087	0.200	-81.64
	20-29	4.57	2.11	-53.95	<0.05**	0.865	0.147	-82.96
	30-39	4.27	1.14	-73.32	<0.05**	0.357	0.054	-84.83
	>=40	2.92	1.06	-63.88	<0.05**	0.239	0.125	-47.56
	Total	4.02	1.23	-69.39	<0.05**	0.560	0.120	-78.56
Biannual mass treatment								
	0- 9	3.08	0.00	-100.00	0.0917	0.492	0.000	-100.00
	10-19	8.73	0.00	-100.00	<0.05**	1.341	0.000	-100.00
	20-29	6.52	1.86	-71.43	<0.05**	0.609	0.050	-91.84
	30-39	4.32	0.82	-81.01	0.083	0.374	0.033	-91.24
	>=40	6.55	0.40	-93.96	<0.05**	1.062	0.008	-99.26
	Total	6.27	0.62	-90.17	<0.05**	0.864	0.017	-98.00
Check zone								
	0- 9	3.85	4.08	+06.03	0.645	0.115	0.931	+706.74
	10-19	8.72	6.48	-25.79	0.408	1.966	1.775	-9.76
	20-29	5.66	4.04	-28.69	0.602	1.594	1.087	-31.81
	30-39	8.70	4.47	-48.61	0.137	1.098	1.482	+35.02
	>=40	3.39	3.10	-8.46	0.974	0.616	0.579	-6.05
	Total	6.08	4.41	-27.51	0.094	1.177	1.148	-2.44

* : Mean mf count of the population

** : Significantly different

- : Decrease

+ : Increase

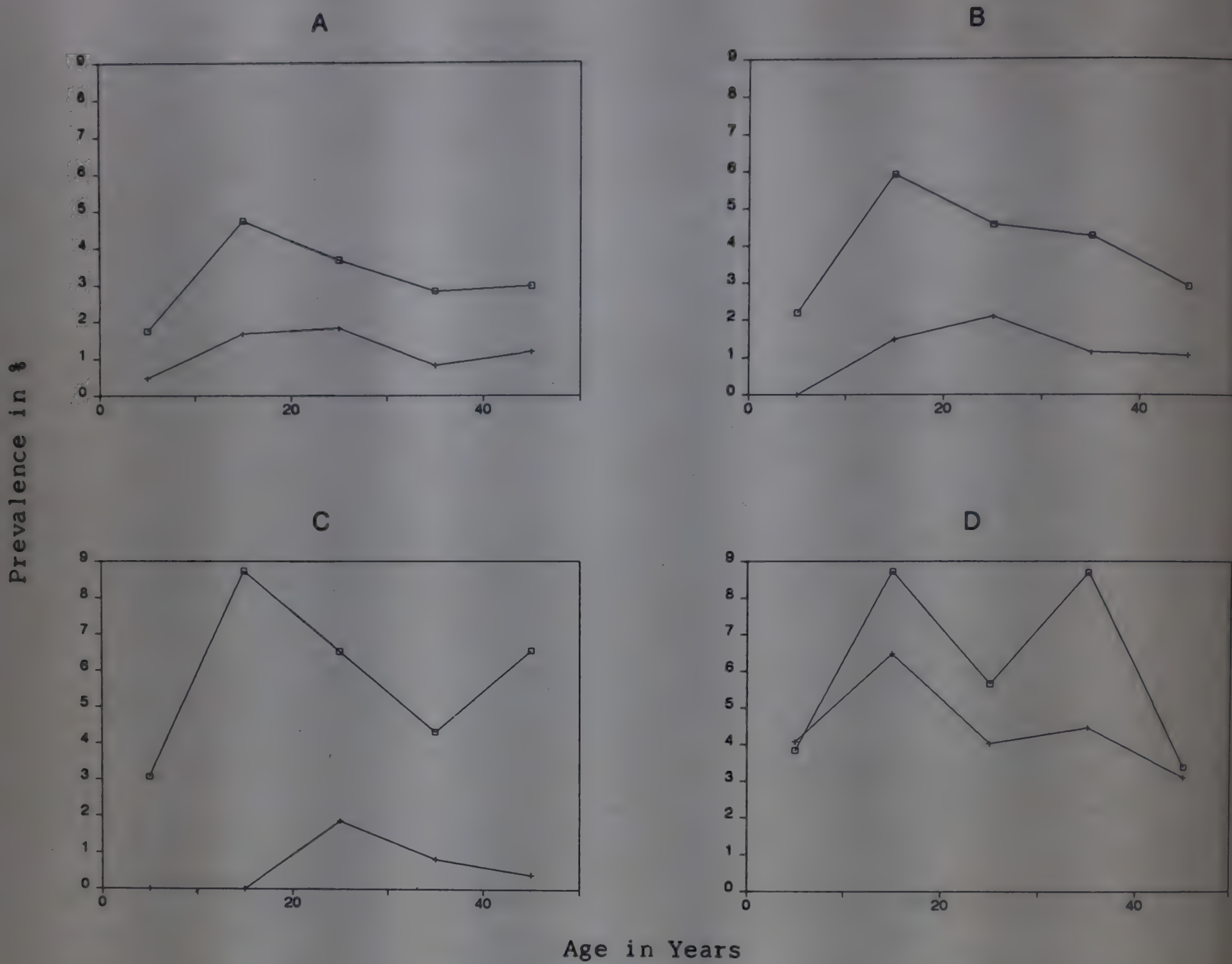


Fig: 1. *Microfilaria* prevalence in pre (□) and post (+) control surveys in vector control (A), annual mass treatment (B), biannual mass treatment (C) and check area (D).

The age specific pattern of mean mF count (mfc) per individual in the pre and post control surveys in the study areas is given in figure 2A-D. A total of 553 cases in vector control area, 814 in annual mass treatment area, 590 in biannual treatment area and 244 in check area were longitudinally followed after a period of three years. The mean mfc per individual in the pre and post control surveys was significantly brought down from 0.99 to 0.01 ($T = 3.83$; $P < 0.05$), from 0.80 to 0.07 ($T = 2.86$; $P = 0.004$) in biannual and annual mass treatment areas respectively. In the vector control area also there was reduction in the mean mfc per individual from 0.78 to 0.17, but it was at its statistical limit ($T = 1.91$; $P = 0.057$). In the check area though there was reduction in mean mfc in the post control survey (1.91 to 1.07) it was not significant ($T = 1.38$; $P = 0.17$) (Table 2).

The average annual incidence of new microfilaria cases in the age class 1-7 years per 1000 population was calculated to be 2.86, 4.86, 9.18 and 2.38 in the precontrol surveys in vector control, annual mass treatment, biannual mass treatment and check areas respectively. There was reduction in the incidence of microfilaraemia in the vector control area (1.43) and no new case were detected in both annual and biannual mass treatment areas in the age class 1-7 in the post control survey suggesting that the incidence of new cases was practically nil. However, in the check area the incidence increased from 2.38 to 28.44.

The rate of acquisition of new infections per individual per annum (Figure 3A), calculated from the longitudinal follow-up of a cohort population with both mF positive and negative cases was observed to be the lowest in biannual mass treatment area (0.0023) which was followed by vector control area (0.0038) and annual mass treatment area (0.0122). In the check area however, it was as high as 0.0133. When the proportion of amicrofilaraemic individuals becoming microfilaraemic in the control areas was compared with that of check area, it was significantly lower in biannual mass treatment area ($P = 0.009$), whereas it was at its statistical limit in vector control area ($P = 0.055$) and the difference was not significant in annual mass treatment area ($P = 0.144$). The rate of loss of infection per case per annum (Figure 3B) was recorded to be the highest in biannual mass treatment area (0.325) which was significantly ($P = 0.038$) different from that of check area (0.241). Though the rate of loss of infection was relatively higher in the annual mass treatment (0.323) and vector control areas (0.269) they were not significantly ($P > 0.05$) different from that of check area. The rate of acquisition in the vector control area was nearly six times lesser than that of check area, reflecting the reduction in transmission following vector control measures. Relatively a higher loss rate of infection recorded both in annual and biannual mass treatment areas indicates the effect of chemotherapy in reducing the parasite load. The effect of biannual mass treatment was com-

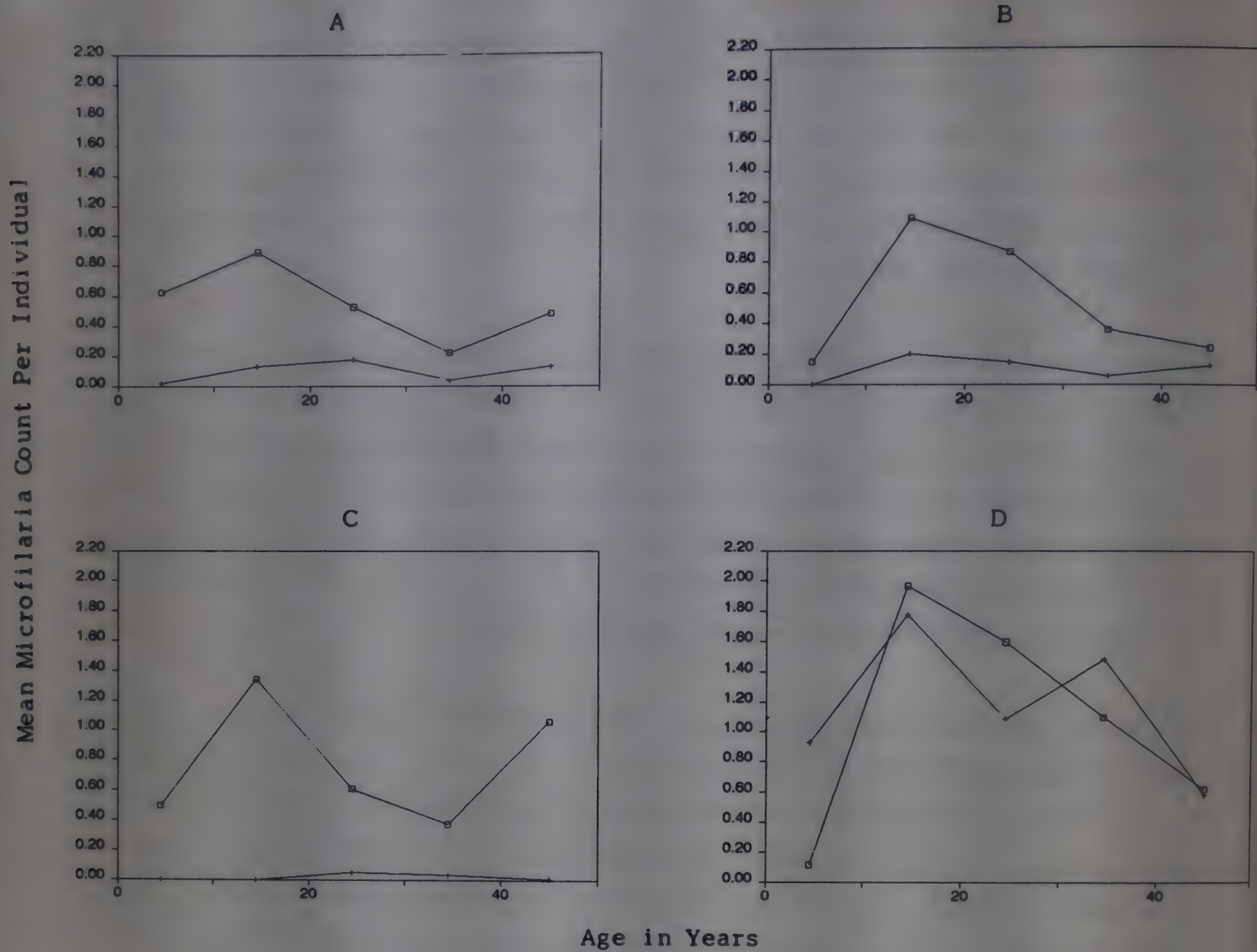


Fig: 2. Mean microfilaria count in pre (□) and post (+) control surveys in vector control (A), annual mass treatment (B), biannual mass treatment (C) and check area (D).

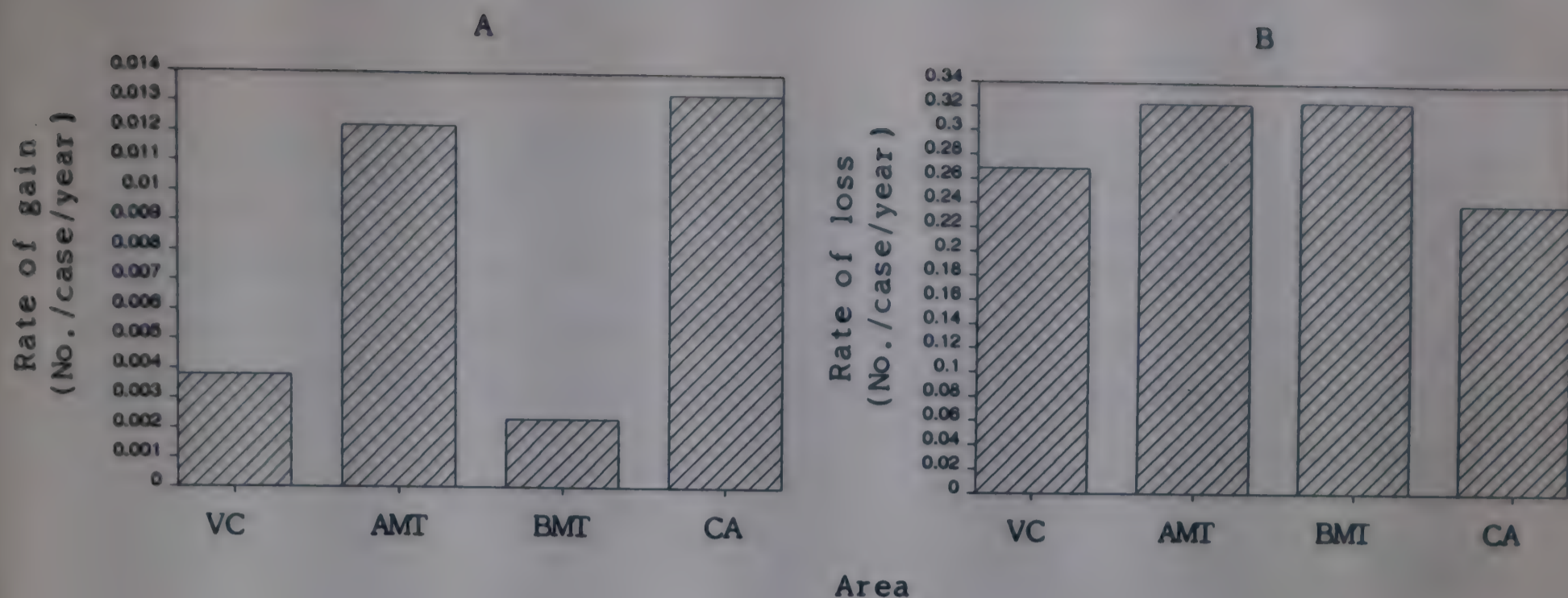


Fig: 3. Rate of gain (A) and loss (B) of infection in vector control (VC), annual mass treatment (AMT), biannual mass treatment (BMT) and check area (CA) following the implementation of the programme.



Fig: 4. Infectivity index of the human population in vector control (VC), annual mass treatment (AMT), biannual mass treatment (BMT) and check area (CA) in pre and post control surveys.

paratively more as there was significant reduction in both acquisition and loss of infection when compared to check area.

The pre control infectivity index of the population in the vector control, annual mass treatment, biannual mass treatment and check area was 1.71, 2.1, 2.7 and 3.72 and was reduced to 0.56 (67.25%), 0.50 (76.19%), 0.25 (90.74%) and 2.18 (41.4%) respectively in the post control survey (Fig. 4). Though there was natural decline in the infectivity index of the population in the check area, as high as 65% reduction was achieved in areas under vector control and parasite control.

Clinical:

The changes in the prevalence of acute manifestations, recent oedema, persistent oedema with or without elephantoid changes and chronic cases associated with or without acute manifestations in the study population is given in table 3. The prevalence of acute manifestations though reduced in all the areas including check area, the reduction in the proportion was significant only in annual mass treatment and vector control areas, whereas it was not statistically different in biannual mass treatment and check areas. The prevalence of recent oedema showed a significant reduction in the post control surveys in all the control areas whereas in the check area the reduction in the post control was not significant (Table 3). When the change in the prevalence of recent oedema cases in the post control survey was compared between different study areas, it was found that the reduction was significantly higher in biannual area ($Z = 9.38$; $P < 0.05$) than that of annual mass treatment which recorded significantly ($Z = 2.53$; $P < 0.05$) higher reduction than that of vector control area. However, in the vector control area it was significantly ($Z = 6.99$; $P < 0.05$) higher than that of check area. Persistent oedema with or without skin changes did not differ significantly from its pre control survey in all the study areas, though the prevalence was observed to be reduced in the post control survey (Table 3). The analysis on the proportion of lymphoedema chronic cases associated with or without acute manifestations such as filarial fever, lymphangitis and lymphadenitis showed that over 60% reduction in the cases associated with acute episodes was significant in all the three areas after the implementation of control measures, whereas it was only 24.8% and not significant in the check area. When this reduction was compared between different study areas, it showed that in biannual mass treatment area it was not significantly ($Z = 0.118$; $P > 0.05$) different from that of annual mass treatment area. However, when compared to vector control area the reduction was significantly higher in both mass annual ($Z = 6.7$; $P < 0.05$) and biannual ($Z = 8.8$; $P < 0.05$) treatment areas, indicating the beneficial effects of mass therapy in reducing the mor-

Table 3. Change in the prevalence of clinical manifestations
in the study population

Area	Type of manifestation	Prevalence in %			Proportion
		Pre- control	Post- control	% change	significance P value
<hr/>					
Vector control		(n=639)	(n=671)		
	1. Filarial fever/ adenolymphangitis	5.48	1.64	70.07	0.0002*
	2. R O	1.41	0.30	78.72	0.0251*
	3. P O & Ele	11.41	9.39	17.70	0.2642
	4. Chronic+acute	10.17	3.73	63.32	<0.05*
Annual mass treatment		(n=751)	(n=807)		
	1. Filarial fever/ adenolymphangitis	5.86	0.62	89.42	<0.05*
	2. R O	1.86	0.12	93.55	0.0002*
	3. P O & Ele	9.64	7.56	21.58	0.239
	4. Chronic+acute	9.59	2.85	70.27	<0.05*
Biannual mass treatment		(n=443)	(n=500)		
	1. Filarial fever/ adenolymphangitis	3.39	1.80	46.90	0.740
	2. R O	2.26	0.20	91.15	0.0032*
	3. P O & Ele	11.29	9.40	16.74	0.398
	4. Chronic+acute	11.74	3.80	67.63	<0.05*
Check area		(n=155)	(n=825)		
	1. Filarial fever/ adenolymphangitis	8.39	4.97	40.76	0.091
	2. R O	1.29	0.61	52.71	0.289
	3. P O & Ele	16.13	11.88	26.35	0.182
	4. Chronic+acute	9.67	7.27	24.82	0.906

R O: Recent oedema

P O & Ele: Persistent oedema and elephantiasis

* : significantly different

bidity of diseased individuals. Age specific analysis showed that the reduction in morbidity in chronic lymphoedema cases was significant ($P < 0.05$) in the age class ≥ 40 years.

Entomological:

All the three species of mansonioides viz., *Mansonia annulifera*, *M.uniformis* and *M.indiana* were observed to be infected and infective with *B.malayi* larvae and hence all the three species were considered together for analysing density and infection. The per man hour density of indoor resting vector mosquitoes ranged from 0.25 to 4.90 in different months during the period prior to the introduction of vector control measures (Fig. 5), the mean density being 2.49. Fortnightly monitoring of resting vector population, carried out for 17 months following fish culture programme showed that the per man hour density fluctuated between 0 and 1.0, ($\bar{x} = 0.40$) and this was significantly ($T = 4.59$; $P < 0.05$) lower than pre control level. The man biting rate of vector mosquitoes (No. per man per night) fluctuated between 11 and 61 during the pre control period ($\bar{x} = 36.5$). During the post control period of vector control it ranged from 0 to 36, with a mean of 10.23 which was significantly ($T = 3.11$; $P < 0.05$) lower when compared to pre control level. In the check area the indoor resting vector density fluctuated from 0.67 to 4.07 ($\bar{x} = 2.2$) and 0.5 to 5.75 ($\bar{x} = 2.42$) for the periods corresponding to pre and post vector control. The man biting rate during the respective periods was 9 to 36 ($\bar{x} = 27$) and 6 to 46 ($\bar{x} = 32$), indicating a natural increase in vector population. In the biannual mass treatment area also there was no significant ($P > 0.05$) change in both indoor resting and man biting density.

The percentage of vector mosquitoes infected with filarial larva, prior to, during and after the implementation of mass treatment in the biannual treatment area, and, for the corresponding periods in check area is shown in fig.6. The infection rate was brought down from 2.05% to 0.77% after mass treatment and the proportion of infected mosquitoes was significantly ($P < 0.05$) lower in the post control period when compared to that of pre control period. The percentage of infective mosquitoes was also brought down to 0.14 from its pre control level of 0.29. Though over 50% reduction in infectivity was achieved, it was not significantly ($P > 0.05$) different. In the check area the percentage of vector mosquitoes infected was 1.57 and 3.57 during the corresponding pre and post control periods of mass treatment. The infectivity rate for the respective periods was 0.26 and 0.54. Thus there was over twofold increase in both vector infection and infectivity in the check area. While infection in vector mosquitoes was noticed in most of the months during the period of observation in the check area, vector infection was noticed only prior to and during the implementation of mass treatment (fig.6). None of the

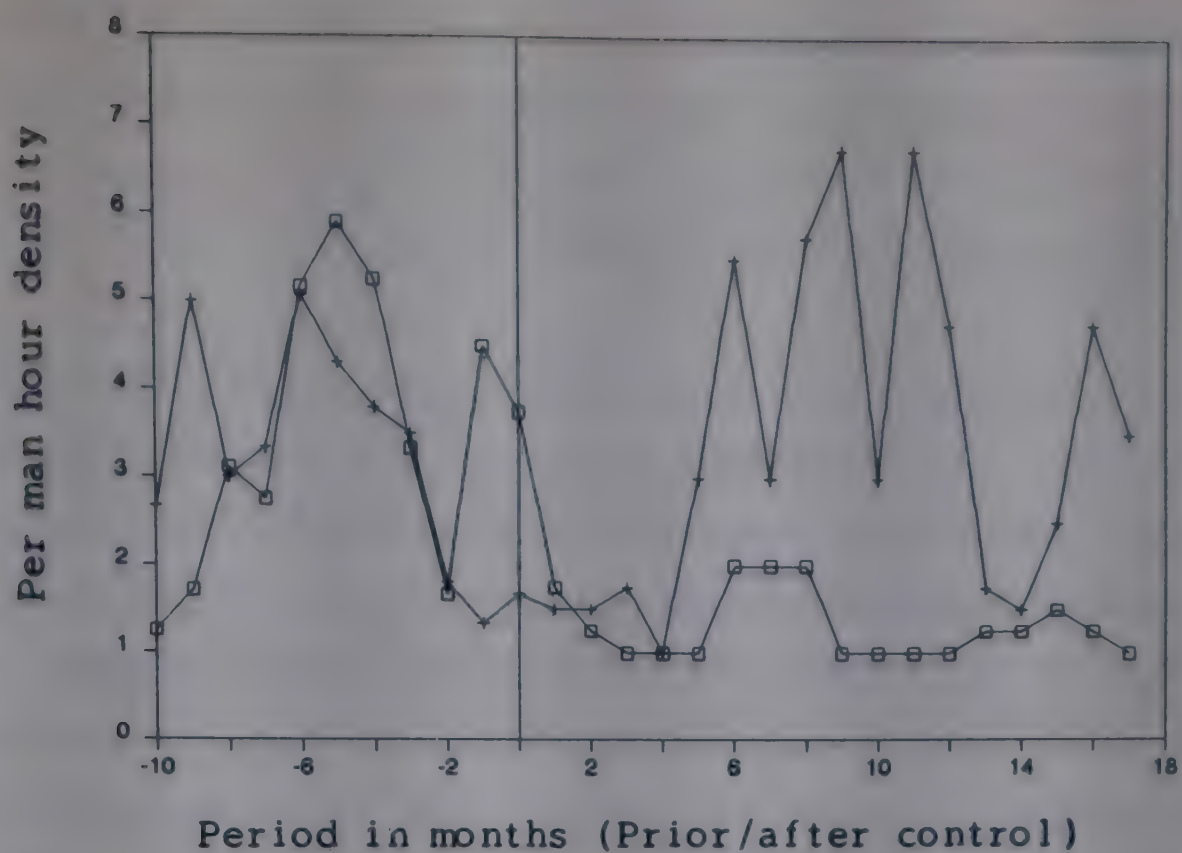


Fig:5. Relative density of indoor resting vector mosquitoes in vector control (□) and check area (+) prior to and after initiation of vector control programme.

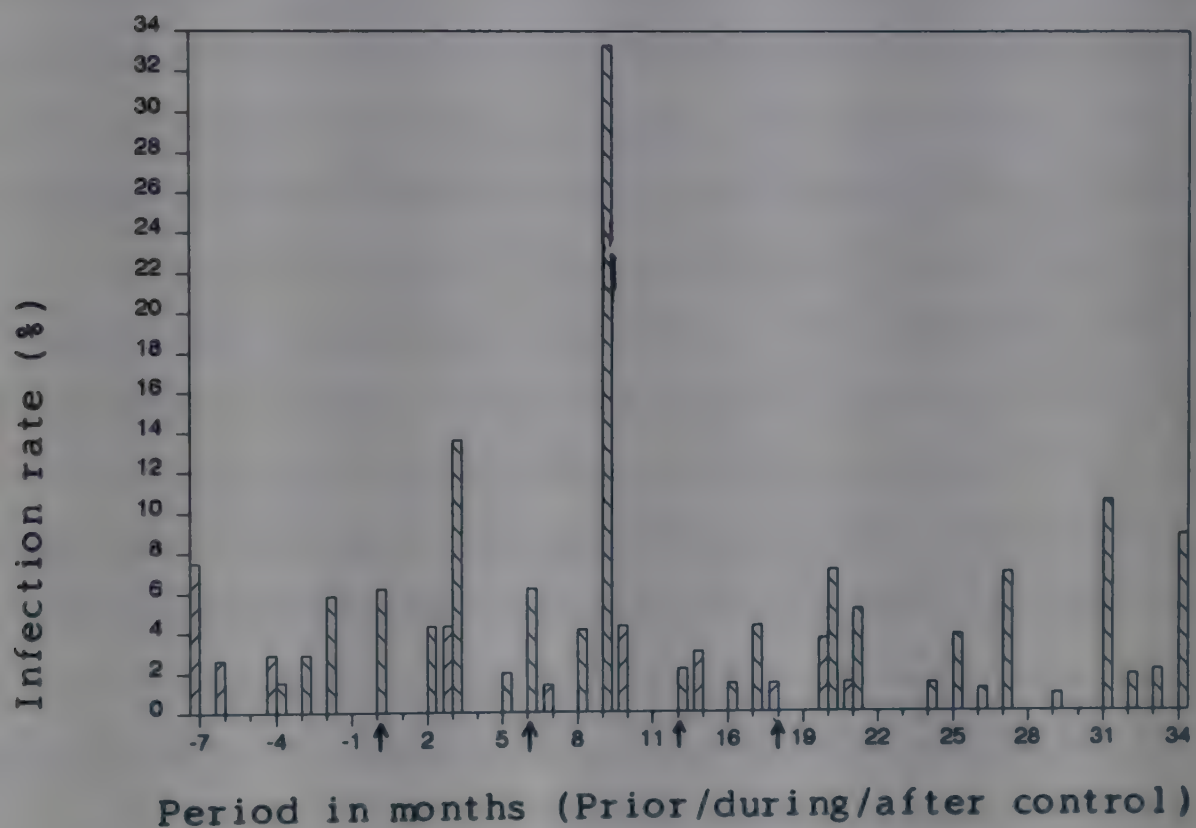


Fig: 6. Vector infection rate in biannual mass treatment (▨) and check area (▤) prior to, during and after implementation of mass treatment.

↑ Indicates the initiation of different rounds of mass treatment.

mosquitoes collected during the period of 14 months following the final round of chemotherapy was found infected. In the vector control area both infection and infectivity rates were very low during the pre control assessment and this did not permit to make any meaningful comparison between the pre and post control periods.

The intensity of infection (No. filarial larva of any stage/mosquito dissected) in the vector population for different months of observation in both biannual mass treatment and check area is shown in fig. 7. There was a decrease in the mean number of filarial larva from 0.184 to 0.087 after the initiation of biannual mass treatment, whereas in the check area it showed an increase from 0.191 to 0.521 during the corresponding periods of observation. However, the number of infective larva per mosquito did not show any change from its pre control level (0.002) in the mass treatment area while in the check area it increased from 0.034 to 0.047.

DISCUSSION

The present study confirms the earlier report on the declining trend of infection prevalence in this area (Rajagopalan, et al., 1990). Significant reduction in mF prevalence and intensity, absence of new infection in the age class 1-7 years, relatively higher reduction in the infectivity potential of human population, and, higher rate of loss of infection following mass treatment with single dose DEC showed that both annual and biannual mass treatments effectively reduced the parasite load in the population. This is evidenced from the significant reduction in the proportion of infected vector mosquitoes as well as over 50 % reduction in the intensity of larvae in the vector population. Thus an effective transmission interruption was achieved in the chemotherapy area. Significant reduction in the recruitment of new lymphoedema cases and reduction in the morbidity among chronic lymphoedema cases suggested its beneficial effects on the diseased individuals. Biannual mass treatment has shown to be superior to annual mass treatment. The side reactions were minimal and following the realisation of beneficial effects of DEC, there was significant increase in coverage in subsequent rounds, reflecting the acceptance of the programme by the community and its feasibility in this locality.

Composite fish culture programme resulted in significant reduction of weed infestation in ponds, and of vector density which was maintained at low level throughout the post control period. Further reduction in vector density was not possible because of the weed infested canals and channels that criss cross the entire taluk. The impact of vector control on infection was evident from the significant reduction of mF prevalence in the post control survey. Interruption in transmission through vector control was indicated from the reduction in the in-

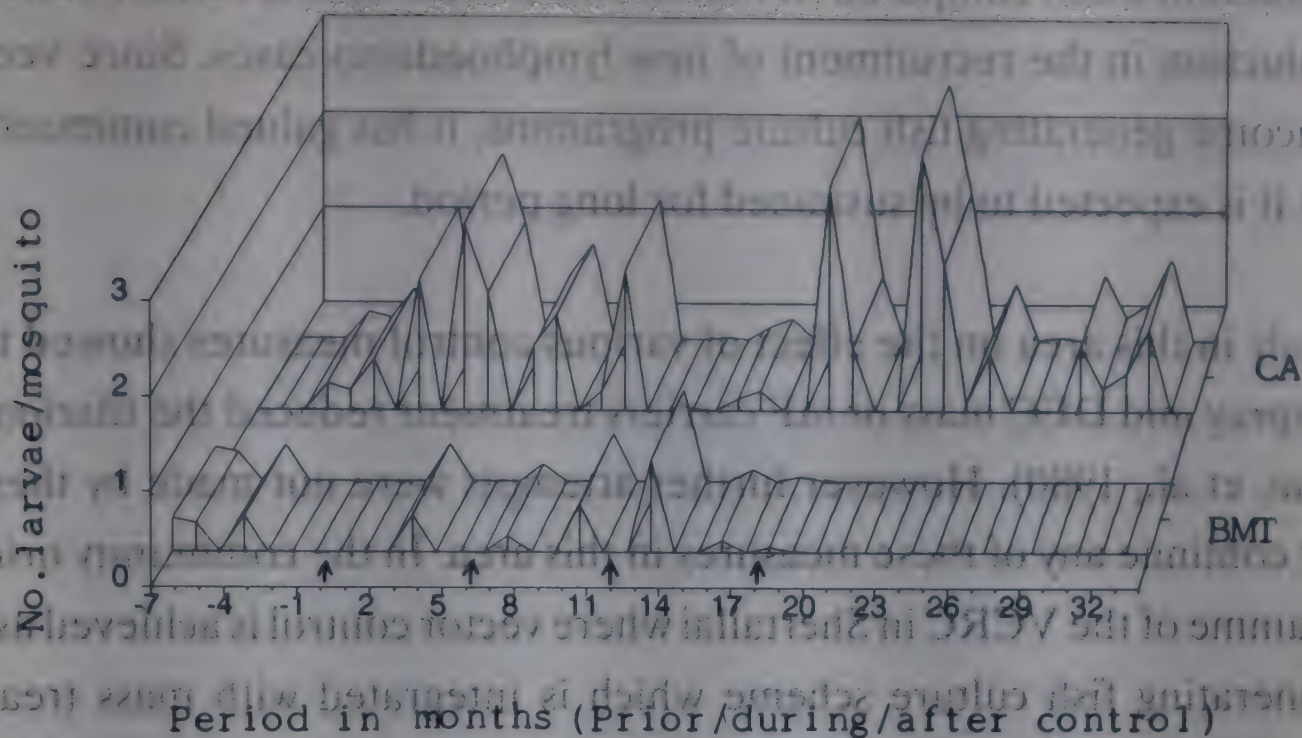


Fig: 7. Intensity of infection in vector population in biannual mass treatment (BMT) and check area (CA), prior to, during and after implementation of mass treatment.

↑ Indicates the initiation of different rounds of mass treatment.

REFERENCES

1. Anonymous. In: *Flavivirus in Kerala* (State Government Press, Trivandrum) 1981 p. 27.
2. Iyengar, M.O.T. Studies on the epidemiology of filariasis in Travancore. *Indian Medical Memoir* 30 (1938) 179.
3. Kumar, E., Peadar, L., Spear, G.T. Epidemiology of subperiodic bancroftian filariasis in Samoa 8 years after control by mass treatment with DEC. *Bull WHO* 63 (1982) 809.
4. Rajagopalan, P.K., Parickar, K.K., Subramanian, S., Krishnamoorthy, K., Sudhakar, R., A. Control of human filariasis in Kerala, South India. *Indian Journal of Tropical Medicine and Hygiene* 1 (1987) 1.
5. Rajagopalan, P.K., Parickar, K.K., and Pillai, S.T. Impact of 20 years of vector control on the prevalence of *Bancroftia* in Kerala. *Indian Medical Memoir* 30 (1938) 179.

cidence of microfilaraemia in the age class 1-7 years as well as relatively low rate of acquisition of new infection when compared to that of check area. This is further reflected from the significant reduction in the recruitment of new lymphoedema cases. Since vector control is linked with income generating fish culture programme, it has gained community acceptance and therefore it is expected to be sustained for long period.

An earlier study in this area on the effect of various control measures showed that combination of HCH spray and DEC mass or mF carriers treatment reduced the filariometric indices markedly (Rao, et al., 1980). However further attempts were not made by these workers to implement or continue any of these measures in this area. In the community oriented disease control programme of the VCRC in Shertallai where vector control is achieved as a by-product of income generating fish culture scheme which is integrated with mass treatment of the population with active involvement of the community, there is a distinct possibility of eliminating the foci of *B.malayi* transmission altogether from this locality. However, there is a need to identify certain criteria in deciding the minimum period of implementation of such programmes because there are reports of increase of infection prevalence after two successful mass drug treatment campaigns (Kimura, 1985).

REFERENCES

1. Anonymous. In: *Filariasis in Kerala* (State Government Press, Trivandrum) 1961 p 27.
2. Iyengar, M.O.T. Studies on the epidemiology of filariasis in Travancore. *Indian Med Res Memoir* 30 (1938) 179.
3. Kimura E, Penaia L, Spears GFS. Epidemiology of subperiodic bancroftian filariasis in Samoa 8 years after control by mass treatment with DEC. *Bull WHO* 63 (1985) 869.
4. Rajagopalan, P.K., Panicker, K.N., Sabesan, S., Krishnamoorthy, K., Sudhakar Rao, A. Control of brugian filariasis in Shertallai, South India. Precontrol epidemiological observations, Pondicherry: Vector Control Research Centre, 7 (1987) 1.
5. Rajagopalan, P.K., Panicker, K.N. and Pani, S.P. Impact of 50 years of vector control on the prevalence of *Brugia malayi* in Shertallai area of Kerala State. *Indian J Med Res* 89 (1989) 418.

6. Rao, C.K., Russel, S. and Chandrasekharan, A. Some aspects of epidemiology of *B.malayi* in India. *J Commun Dis* 10 (1978) 261.
7. Rao, C.K., Chandrasekharan, A., Kaul, S.M., Narasimham, M.V.V.L. and Sharma, S.P. Relative effectiveness of different methods of control of Brugian filariasis in India. *Indian J Med Res* 72 (1980) 194.
8. Report of the 12th meeting of the Scientific working group on filariasis. Lymphatic pathology and Immunopathology in filariasis. *TDR/FIL-SWG(12)/85* 3 (1985) 1.
9. Sharma, S.P., Biswas, H., Das, M. and Dwivedi, S.R. Present status of filariasis problem in India. *J Commun Dis* 15 (1983) 53.
10. Singh, Jaswanth, Krishnaswami, A.K. and Raghavan, N.G.S. Filariasis in Travancore-Cochin State II. Shertallai taluk. *Indian J Malariol* 10 (1956) 317.
11. Third report of WHO expert committee on lymphatic filariasis. *WHO Tech Rep Ser* 542 (1974) 1.
12. Vanamail, P., Subramanian, S., Das, P.K., Pani, S.P., Rajagopalan, P.K. Bundy, D.A.P. and Grenfell, B.T. Estimation of age specific rates of acquisition and loss of *Wuchereria bancrofti* infection. *Trans Roy Soc Trop Med Hyg* 83 (1989) 689.

